WETLAND INVENTORY UPDATE
YEAR 5 SYNTHESIS REPORT
2009

May 17, 2010

Water Resources Division
Lummi Natural Resources Department
Lummi Indian Business Council

LUMMI NATION

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1. INTRODUCTION

The Lummi Indian Reservation (Reservation, see Figure 1) is located along the western boundary of Whatcom County, Washington and includes the mouth of the Nooksack and Lummi rivers. Both the Nooksack and Lummi river watersheds are under environmental pressures from rapid regional growth. The Lummi Nation has also entered a period of rapid economic development under self-governance. Growth on and near the Reservation requires that the Nation's core environmental program prioritize the development of a regulatory infrastructure that is technically sound, legally defensible, and administratively efficient and that allows for growth while protecting tribal resources and the Reservation environment. This regulatory infrastructure supports both the tribal goal and the Environmental Protection Agency (EPA) policy of tribal self-governance and recognition of sovereignty.

Previous EPA and other funding sources have supported the Lummi Nation's assessment of priority water resource needs and the identification of unmet needs. Environmental planning intended to protect the Nation's water resources has included development of a Storm Water Management Program (LWRD 1998a), a Wellhead Protection Program (LWRD 1997, LWRD 1998b), a Wetland Management Program (LWRD 2000), a Non-Point Source Management Program (LWRD 2001, LWRD 2002), and Water Quality Standards for Surface Waters of the Lummi Indian Reservation (LWRD 2008). These programs are components of a comprehensive water resources management program (CWRMP) being developed and implemented pursuant to Lummi Indian Business Council (LIBC) resolutions No. 90-88 and No. 92-43.

In January 2004, the Lummi Nation Water Resources Protection Code (Title 17 of the Lummi Code of Laws [LCL]) was adopted. Based on a Reservation-wide wetland inventory completed in 1999 (Harper 1999) and as described in Chapter 17.06 (Stream and Wetland Management) of LCL Title 17, different types of wetlands that vary in their quality and importance occur on the Reservation. In order to establish appropriate levels of protection, pursuant to LCL Chapter 17.06 the Reservation wetlands must be classified into one of four categories. Category 1 wetlands are considered critical value wetlands that have a high and irreplaceable level of importance for fisheries, Lummi culture, and/or water quality on the Reservation. Category 2 wetlands are difficult to replace, but not impossible. They provide high levels of some functions and still need a high level of protection. Category 3 wetlands provide a moderate level of functions and are often less diverse. Category 4 wetlands have minimum habitat value and are suitable for restoration or enhancement efforts.

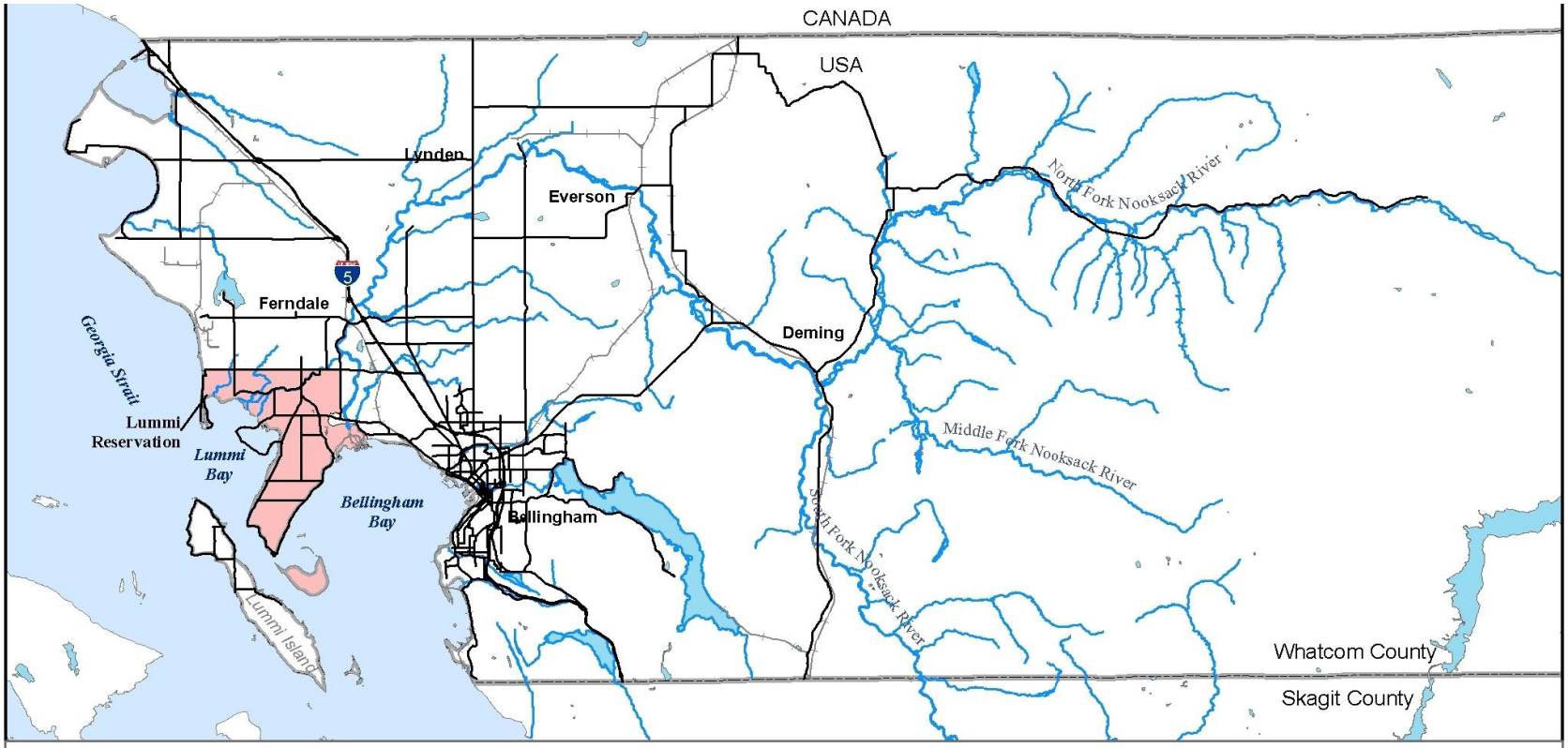


Figure 1 - Regional Location of the Lummi Indian Reservation, Washington

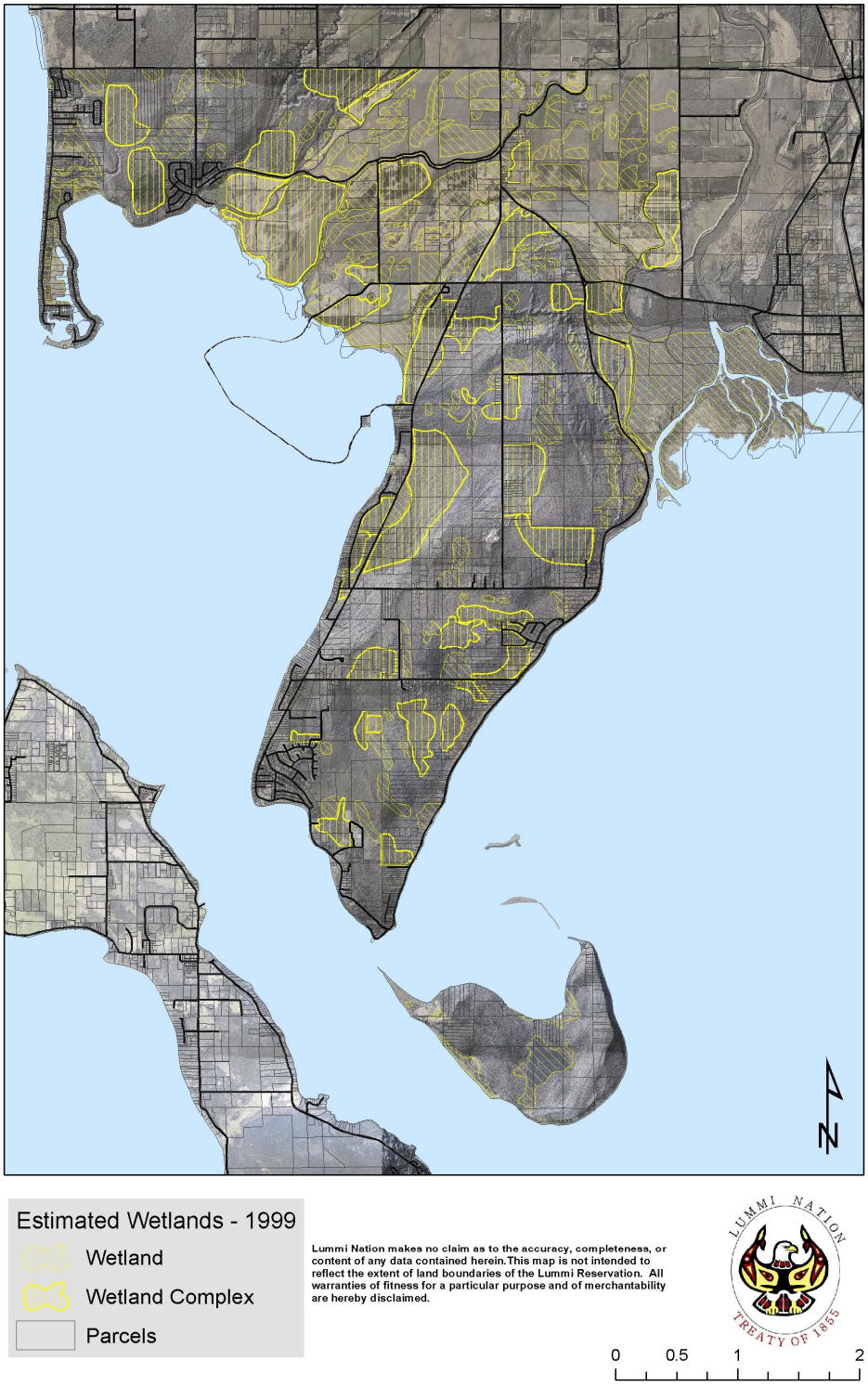
The purpose of the 1999 Reservation-wide wetland inventory was to identify wetland locations and to collect information on the characteristics and functions of the Reservation wetlands. The 1999 Reservation-wide wetland inventory (Harper 1999) relied largely on remotely sensed data (i.e., color and infra-red aerial photographs), generalized mapping (i.e., USDA soil survey), and limited field verification to identify wetland locations and sizes. In addition to identification and mapping, the 1999 inventory collected general wetland information including Cowardin classification (Cowardin et al. 1979), water source, and soil type. The Washington State Function Assessment Method was applied to 12 assessment units (AUs) in 9 selected wetlands on the Reservation. The 1999 inventory identified and mapped a total of 214 wetlands and wetland complexes on the Reservation (Figure 2). These wetland areas totaled 5,432 acres, or roughly 43 percent of the land area of the Reservation, excluding tidelands. Approximately 60 percent of these mapped wetland areas are located in the flood plains of the Lummi and Nooksack rivers.

Although the 1999 inventory represents an important planning tool and a significant improvement over the previously available information, which was largely from the National Wetlands Inventory (USFWS 1987), the 1999 inventory has proven to be too general for many planning efforts. The 1999 inventory either did not map some wetlands or generally shows larger wetland areas than are surveyed in the field or identified using Global Positioning System (GPS) technology. Refining the spatial resolution of wetland mapping, performing function assessments, and classifying the wetlands into the regulatory categories identified in Title 17 is intended to support efforts to protect these wetland resources and the important ecological, hydrological, and water quality protection functions that they provide. Because of the large number of wetland areas on the Reservation, the effort to refine the spatial resolution of the wetland mapping, to perform function assessments, and to classify the Reservation wetlands is projected to require several years to complete. This report summarizes the results of Year 5 of this inventory update effort.

As described in more detail below, a wetland-consulting firm was contracted following Year 3 of the update effort to provide an independent program evaluation and quality assurance/quality control review. As a result of this evaluation and review, the function assessment element of the wetland inventory update effort was de-emphasized during Year 4. For this Year 5 update effort and future update efforts, function assessments are deferred for wetlands until a development activity is imminent and the assessment is needed to determine appropriate mitigation measures for any unavoidable wetland impacts.

For the purposes of this inventory update, a wetland evaluation consists of conducting a site visit(s), performing at least a detailed reconnaissance-level delineation, using a mapping grade GPS unit to map the identified wetland boundaries, and classifying the wetlands into one of the four categories.

Figure 2 - 1999 Wetland Inventory Results



This approach to updating the Reservation-wide wetland inventory resulted in the evaluation of 48 wetlands during Year 5 (approximately 22.42 percent of the total number of wetlands identified during the 1999 inventory). When combined with the 36 wetlands identified during Year 1, 35 wetlands identified during Year 2, 20 wetlands identified during Year 3, and 14 wetlands identified during Year 4, a total of 153 wetlands (approximately 71.50 percent) of the Reservation wetlands have been evaluated.

Based on this experience and assuming the same evaluation methodology and rate, additional time will be required to complete an evaluation of all of the Reservation wetlands.

This Year 5 wetland inventory update synthesis report is divided into the following sections:

- Section 1 is this Introduction section.
- Section 2 describes the methods used to conduct the mapping and categorization of Reservation wetlands.
- Section 3 presents a summary of the results of Year 5 of the wetland inventory update.
- Section 4 provides a discussion of the Year 5 results.
- Section 5 lists the references cited in the report.

Appendix A contains a map of each wetland mapped during the fifth year of the inventory update. The results from Year 1, Year 2, Year 3, and Year 4 are summarized in similar synthesis reports (LWRD 2005, LWRD 2006, LWRD 2007, and LWRD 2009). The field notes and categorization worksheets for each wetland and function assessment are on file with the Lummi Water Resources Division. In Appendix B, an example of the field categorization and function assessment worksheets completed for each wetland is provided.

2. METHODS FOR WETLAND INVENTORY UPDATE

The methods used to update and refine the spatial resolution of the 1999 inventory are described below. Lummi Water Resources staff and two consulting firms (Northwest Ecological Services and AMEC Earth and Environmental, Inc.) hired by the Lummi Planning Department, the Lummi Housing Authority, or the Lummi Tribal Sever and Water District collected and interpreted the field data summarized in this update.

Four inter-related methods were used to update and refine the 1999 inventory. The different methods were used for wetland mapping/boundary determination, wetland function assessment, wetland rating/classification, and for updating the Lummi Nation GIS wetland inventory/database.

2.1 Method for Wetland Mapping/Boundary Determination

Because of property access issues and the remoteness and size of some of the Reservation wetlands, it is not practical to undertake a geography-based approach (i.e., watershed by watershed) to selecting the wetlands evaluated during this study. Instead, the locations of the wetlands evaluated during this inventory update were based on areas where property was considered for purchase by the LIBC, development actions were contemplated, and/or on parcels for which Lummi Land Use Permit Applications were submitted to the Lummi Planning Department. In several areas, small and moderate-sized wetland areas were discovered that were not identified in the 1999 inventory.

During the planning stages for this update effort, it was estimated that approximately 70 wetlands could be evaluated during one year (approximately three days per wetland). This estimate proved to be overly optimistic due to a number of factors including property access issues and the remoteness and size of some of the wetlands. There were also seasonal considerations including long periods of flooding, frozen ground, and snow that limited and/or prevented wetland boundary determination during portions of the winter season. During the summer season, mapping forested wetland areas is problematic because GPS satellite signals are often difficult to obtain through the dense tree canopy.

Of the 214 wetlands on the Reservation that were mapped during the 1999 inventory, 48 wetland areas were field verified and mapped during Year 5 of this update effort. Eight function assessments were conducted and ratings/classifications were performed on all 48 of the wetland areas during this inventory update effort (approximately 22 percent of the total number of inventoried wetlands during 1999).

In several cases, development actions were planned on a parcel of land where the 1999 inventory indicated that large wetlands or wetland complexes were located over contiguous parcels. Because acquiring landowner permission is

time consuming – particularly for undivided parcels in trust status that may have in excess of 100 landowners, in many cases only a portion of the wetland boundary on the particular parcel where the development action was planned was mapped. As a result, there are several wetlands and numerous fragments of wetlands that have been mapped by Lummi Water Resources Division staff during the last several years. These areas are mapped or partially mapped and appear in Figure 3, Figure 4, and Appendix A. Work is in progress on these areas, and function assessments and classification/ratings have not yet been performed due to time constraints, adverse weather, and/or other reasons. These areas have been archived in the Lummi Nation Geographic Information System (GIS) so that work can continue on these wetlands and mapping, function assessments, and categorization can be finalized in the future as this wetland inventory update is completed.

Once a wetland from the 1999 inventory or a land parcel is selected for evaluation, the methodology used to reliably identify and map the wetland boundaries is the following:

1. Prior to conducting a field visit, available remotely sensed data including high resolution aerial photography collected during 2004 and 2008 (approximately 0.5 feet resolution) and high-resolution (approximately ±0.5 feet accuracy) topographic information acquired in 2005 using Light Detection and Ranging (LiDAR) technology are reviewed. Maps developed as part of the USDA soil survey for the area (USDA 1992) are also reviewed.
2. Information developed during the 1999 wetland inventory, including watershed name and size, wetland size, Cowardin classes present, association with streams or other water resources, and USDA soil units in the vicinity are reviewed.
3. During the field visit(s), one of the following two methods for determining wetland boundaries are used:
    - If development activities are planned that would potentially impact wetlands, or a jurisdictional determination of the wetland boundary is required, the wetland boundary is determined in the field using the criteria and methodology of the Wetland Delineation Manual (Manual) issued by the U.S. Army Corps of Engineers (COE 1987) and/or the criteria and methodology in the new Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (COE 2008). The manuals require examination of three parameters: vegetation, soils, and hydrology. The methodology in the new 2008 manual is now used for all wetland determinations. This methodology requires evidence of at least one positive wetland indicator for each of the three parameters (vegetation, soils, and hydrology) to make a positive wetland determination. The specified criteria are mandatory and must all be present under normal environmental conditions. Once delineated, the wetland boundaries are recorded using a handheld Trimble GeoXT

GPS unit, and downloaded into the ArcMap9 GIS software program. The horizontal accuracy of the Trimble GeoXT GPS unit is ± 2 feet once the collected data are post-processed.

- If development activities are not planned, and or other conditions make locating the boundary difficult (e.g., lack of satellite configuration for the GPS unit, lack of permission to access property), a "reconnaissance-level" boundary determination is made instead of a jurisdictional determination. Much more time would be required if jurisdictional determinations were made on all the wetlands because wetland data plots along regularly spaced transects would be required. For the reconnaissance level determinations, the same criteria are applied but in a less formal manner, or in some cases, only a portion of the wetland edge was recorded using a GPS unit, and the rest of the wetland boundary estimated using a combination of other methods (e.g., aerial photography and LiDAR). In some cases, portions of the wetland boundaries were recorded using a combination of an on-the-ground reconnaissance, GPS data, soil mapping, LiDAR data, and recent aerial photography.

2.2 Method for Wetland Function Assessment

Pursuant to the recommendations from the independent program evaluation/review completed by ESA Adolfson during October through December 2007 (ESA Adolfson 2008), wetland function assessments are now being deferred until a development action is planned that will impact a wetland and a function assessment is required to determine appropriate mitigation for unavoidable wetland impacts. This program modification is anticipated to allow more of the Reservation wetlands to be visited during a year and to accelerate the completion of the inventory update.

When wetland function assessments are conducted on the Lummi Reservation, the *Methods for Assessing Wetland Functions, Volume 1* by the Washington State Wetland Function Assessment Project (Hruby et al. 1999) are used. The Washington Method (commonly called WAFAM) is based on the nationally recognized Hydrogeomorphic (HGM) approach (Brinson 1993), which classifies wetlands based on landscape position and water regime, and provides guidance on arriving at technical assumptions on which performance assessments of functions are based. The HGM method proposes the following classes of wetlands: Depressional, Fringe, Slope, Riverine, and Flats (Brinson 1993). The Washington State technical committee has thus far developed assessment methods only for depressional and riverine wetlands. Most of the wetlands on the Lummi Reservation fall into these two categories, although estuarine fringe and flats are also clearly present.

The WAFAM (Hruby et al. 1999) relies on indicators of functions to assess potential performance, rather than direct measurements. Indicators are usually physical characteristics of the wetland or its surrounding area that can be correlated to a specific function. For example, rather than trying to directly sample aquatic mammals, the presence of steep banks in the wetland can be used as an indicator of the suitability of the wetland habitat for aquatic mammals. After collecting detailed data on indicators, mechanistic models (mathematical equations) are applied to the data to arrive at a numeric index score. This step is based on the assumption that the relationship between indicators and the actual performance level for a function can be defined by a simple mathematical expression. Different models were developed for each subclass of wetland and for each function category (Hruby et al. 1999).

The function assessment method implemented for this Year 5 update was the *Washington State Department of Transportation (WSDOT) Wetland Functions Characterization Tool For Linear Projects* (Null et al. 2000). This WSDOT tool is based on the WAFAM methodology, which was modified because the WSDOT realized that it would be neither feasible nor necessary for routine application on linear highway projects that make up the majority of its wetland evaluations.

Through the WSDOT, the Wetland Strategic Plan Implementation (WSPI) committee developed a rapid assessment tool for wetland functions based on Best Professional Judgment (BPJ). The BPJ tool does not quantify wetland functions or provide a comprehensive study of an entire wetland system, and it should not be used when a more intensive study is needed. The purpose of this tool is to provide a consistent format for the rapid characterization of wetland functions for routine linear highway projects. The qualitative tool is intended for use where a general characterization of wetland functions is needed but extensive field investigation is not practical or necessary.

The WSDOT tool (Null et al. 2000) was developed to assist the evaluator when observing site conditions to determine whether or not a particular function or value is likely being provided. The guidance section of the tool is intended to help the evaluator consider whether a suite of qualifiers is present or absent and then, using BPJ, determine whether or not a particular function or value is likely to be provided. Functions and values that are evaluated include:

- Hydrologic Functions – flood flow alteration, sediment removal, nutrient and toxicant removal, and erosion control and shoreline stabilization.
- Biological Functions – production of organic matter and its export, general habitat suitability, habitat for aquatic invertebrates, habitat for amphibians, habitat for wetland associated mammals, habitat for wetland associated birds, general fish habitat, and native plant richness.
- Social Values – educational or scientific value, and uniqueness and heritage.

Positive answers to a suite of qualifiers generally indicate the presence of factors important for a function or value. These qualifiers are furnished to guide the characterization of a function or value that is likely to be provided. Some examples of qualifiers are listed below; the qualifiers are marked as a number in the rationale column on the Wetland Functions and Values Form of the tool. All of the functions, values, and associated qualifiers illustrated in the guidance section of the BPJ tool are listed in Appendix B.

- Wetland receives floodwater from an adjacent water course.
- Slow-moving water and/or a deepwater habitat are present in the wetland.
- Sediment deposits are present in wetland.
- A herbaceous layer is part of this dense vegetation.
- Upland surrounding wetland is undeveloped.
- Thin-stemmed emergent and/or floating aquatic vegetation present within areas of seasonal and/or perennial standing water.
- Presence of banks suitable for denning.
- Snags present in wetland or its buffer.
- Observation of fish.
- Wetland has mature trees.
- Site has documented scientific or educational use.
- Wetland has biological, geological, or other features that are determined rare by the local jurisdiction.

After completing each section, the evaluator should use best professional judgment to determine the likelihood of that function being provided along with the function's relative importance. This characterization, along with the supporting rationale should be documented on the Field Data Form.

2.3 Method for Wetland Rating/Classification

There is currently no tribal or federal rating system to categorize wetlands based on functions and values. As a result, the Washington State Department of Ecology's *Wetland Rating System for Western Washington – Revised* (Hruby 2004) was used to classify Reservation wetlands. This document is a revision of the *Washington State Wetland Rating System for Western Washington,* published by the Department of Ecology in (Ecology 1991). The 2004 version was used for all wetlands inventoried for this Year 5 effort.

The current version of the wetland classification system was designed to differentiate between wetlands based on their sensitivity to disturbance, their significance, their rarity, the ability to replace them, and the functions they provide. The classification system results in rating wetlands into one of the following four categories:

- Category 1 wetlands are those that represent a unique or rare wetland type, or are more sensitive to disturbance than most wetlands, or are relatively undisturbed and contain ecological attributes that are impossible

to replace within a human lifetime, or provide a high level of functions (scores > 70 points).

- Category 2 wetlands are difficult, though not impossible to replace, and provide high levels of some functions (scores between 51 – 69 points). These wetlands occur more commonly than Category 1 wetlands, but still need a relatively high level of protection.
- Category 3 wetlands are wetlands with a moderate level of functions (scores between 30 – 50 points). They have been disturbed in some ways, and are often less diverse or more isolated from other natural resources in the landscape than Category 2 wetlands.
- Category 4 wetlands have the lowest levels of functions (scores less than 30 points) and are often heavily disturbed. These are wetlands that could be replaced, and in some cases, improved. These wetlands may provide some important ecological functions, and also need to be protected.

The rating categories were largely adopted in LCL Title 17. The categories are intended to be the basis for wetland protection and management to reduce further loss of their value as a resource. Some decisions that can be made based on the rating include the width of buffers needed to protect the wetland from adjacent development, the mitigation ratios needed to compensate for impacts to the wetland, and permitted uses in the wetland. The wetland categorization or rating is the basis for determining the size of wetland buffers on the Reservation (LCL Title 17).

As a component of the rating process, a classification key was used to determine whether the wetland was riverine, depressional, slope, lake-fringe, tidal fringe, or tidal flats according to the HGM classification system.

2.4 Method for Updating the Lummi Nation GIS Wetland Inventory/Database

As described in Section 2.1, the updated wetland boundaries were recorded using a mapping-grade Trimble GeoXT GPS unit, and downloaded into ArcMap9 GIS software. Once entered into the GIS, any newly identified wetland areas were assigned an identification number based on the Public Land Survey System (Township, Range, and Section). If a newly delineated wetland area essentially replaced an existing wetland, the original identification number was retained. If a new wetland was identified, a new number based on the Public Land Survey System was assigned. Other data that were entered into the GIS database for new wetlands included wetland area in acres and hectares, comments about location or other unique features of the wetland, wetland rating/classification, hydrogeomorphic classification, Cowardin classification, the date the wetland was mapped, and watershed name. The Lummi Water Resources Division started developing a new Access database during 2007 to better manage the collected information on the Reservation wetlands. This database needs additional work before it can be fully operational.

3. WETLAND INVENTORY UPDATE RESULTS

The results from Year 5 of the wetland inventory update are summarized below. Detailed field forms for the wetland areas are maintained on file at the Lummi Water Resources Division office. An example of the documentation is included as Appendix B and Appendix C of this synthesis report.

3.1 Results of Wetland Mapping and Boundary Determination during 2009

The 48 wetland areas on the Lummi Reservation that were field-verified and mapped during Year 5 of the wetland inventory update effort are shown in Figure 3. Detailed maps of each of these wetland areas are presented in Appendix A. Figure 3 and each of the detailed maps presented in Appendix A show the wetland boundaries determined during the various years using different colors. The wetland boundaries identified as part of the Year 5 inventory update are shown in magenta, Year 4 in red, Year 3 in brown, Year 2 in blue, Year 1 in green, and the estimated wetland boundaries from the 1999 inventory in yellow. Where wetland areas are small and/or wetlands were close together, several wetlands are shown on the same map in Appendix A. As summarized in Table 1, a total of approximately 125 acres of wetlands were mapped during Year 5. A comparison of the wetland acreage mapped during the first five years of this update effort is also summarized in Table 1.

Table 1. Comparison of Wetland Areas Evaluated by Program Year

Year	Number of Wetlands Evaluated	Evaluated Wetland Area (acres)
1 (2005)	36	1,104
2 (2006)	37	579
3 (2007)	20	380
4 (2008)	14	28
5 (2009)	48	125
Total	**155**	**2,216**

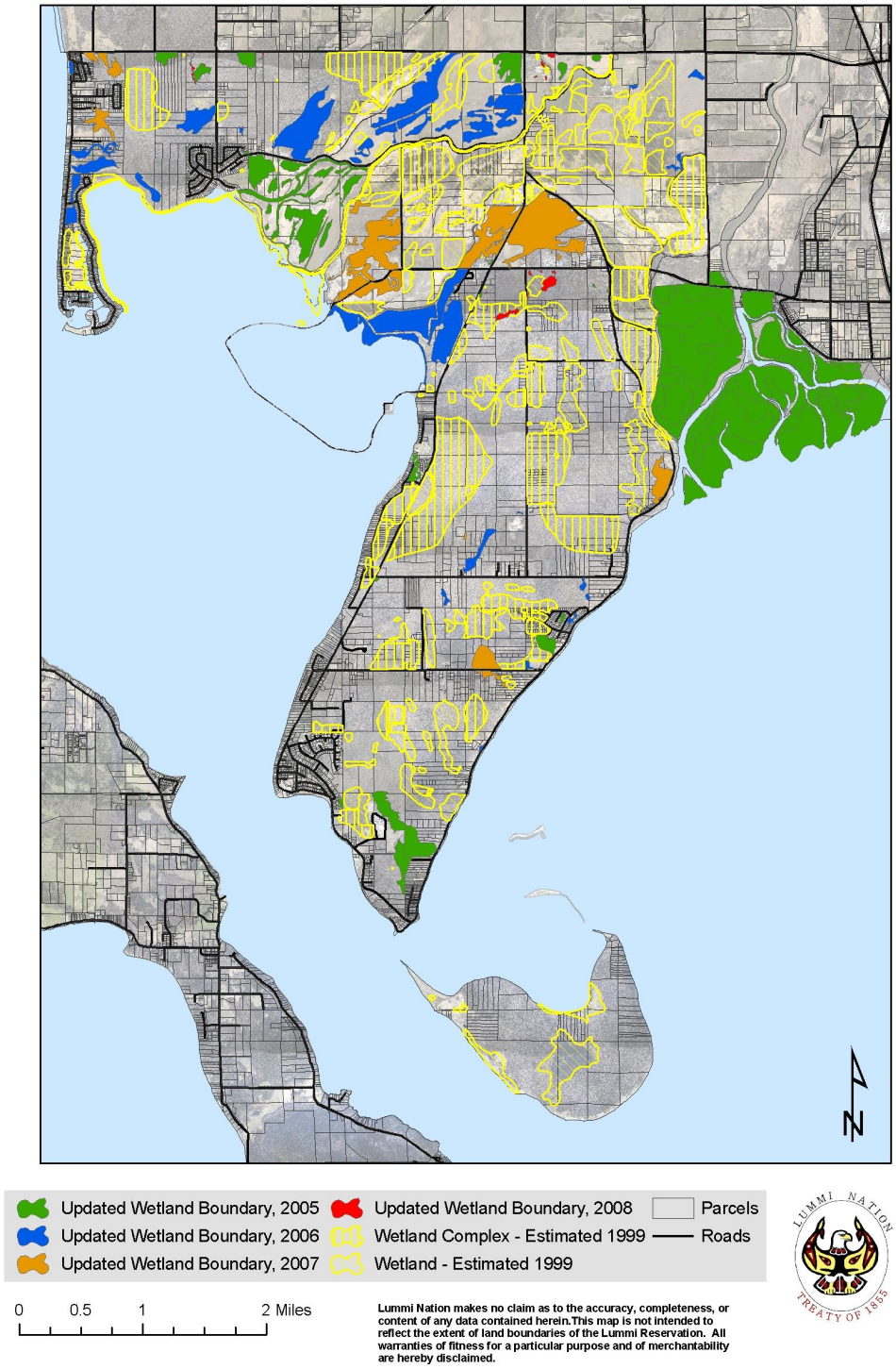
The annual variations in the reported acreage of mapped wetlands are due to a number of factors including:

- The Year 1 Report summarized work that occurred over a period of almost 3 years.
- The Year 2 Report summarized work that occurred over a 1-year period.
- The Year 3 Report summarized work that occurred over a 9-month period with a reduced work week as the Water Resources Planner II worked only 32 hours a week starting in June 2006.
- The Year 4 Report summarizes work that occurred over an 11-month period that included a Quality Assurance/Quality Control effort with ESA Adolfson, a re-verification of some wetland boundaries by Douglass

Consulting, and the reorganization of the Lummi Natural Resources Water Resources Division. This reorganization eliminated the Water Resources Planner II position and created a Water Resources Planner I position. The staff transition included an investment in formal training and practical/field applications with various wetland scientists, which reduced the amount of time available to advance the wetland inventory update effort.

- This Year 5 Report summarizes work that occurred over a 1-year period including work completed in conjunction with wetland contractors hired by the Lummi Planning Department, Lummi Housing Authority, or the Lummi Tribal Sewer and Water District.

Figure 3 - Updated Wetland Boundaries and Estimated Wetland Locations



As shown in Figure 3 and the higher resolution mapping presented in Appendix A, the boundaries of some of the wetlands evaluated during Year 5 changed to some extent in comparison to the 1999 inventory. The wetland mapping and boundary determinations made during Year 5 and the associated wetland sizes compared with the 1999 inventory results are shown in Table 2.

A total of 48 wetland areas on the Reservation were evaluated as part of the year 5 wetland inventory update project (Table 2). As summarize in Table 2, 33 of the wetland areas inventoried and mapped during Year 5 were not identified in the 1999 inventory. Of these 33 wetland areas, 25 of these wetlands (76 percent) were less than 1/3 acre in size. Twelve of these 33 wetland areas were previously field-verified and mentioned in the Year 1 Inventory Update (38N1E35-10 and 19; 37N1E02-10, 11, 12, 13, and 16; 38N1E23-10, 12, and 14; 38N1E13-14 and 15). During the Year 5 update these twelve wetland areas were re-verified for specific project development purposes. Table 2 lists these twelve wetlands and their verified acreage. As a result there are 21 newly identified wetland areas for this Year 5 update with a combined total of 10.75 acres. When combined with the Year 1, Year 2, Year 3, and Year 4 wetland inventory update results (LWRD 2005, LWRD 2006, LWRD 2007, LWRD 2009), a total of 56 wetland areas totaling 85.2 acres have been identified that were not identified in the 1999 inventory. Because the size of the inventoried wetlands have been more accurately determined as part of the wetland inventory update project, in some cases the acreage has increased and in other cases the wetland acreage has decreased. When combined with the results from Year 1, Year 2, Year 3, and Year 4 (LWRD 2005, LWRD 2006, LWRD 2007, LWRD 2009), the net change in the total acreage of Reservation wetlands relative to the 5,432 acres inventoried in 1999 has been a decrease of approximately 475.4 acres. The net result from Year 5 update is a 221.4 acre reduction in the total acreage of Reservation wetlands relative to the 1999 inventory results. Most of this reduction came from the more detailed mapping of the area indentified as a large wetland complex during the 1999 inventory (Wetland 38N1E23-03).

Table 2 – Wetland Size Comparison Results

Wetland ID Number	Watershed Identification	1999 Inventory Wetland Size (Acres)	Inventory Update Wetland Size (Acres)	Difference in Wetland Size (Acres)
38N1E26-10	D	0[1]	0.15	+0.15
38N1E26011	D	0.56[2]	0.03	-0.53
38N2E06-03	K	2.90[3]	4.44	+1.54
38N1E12-20	K	0[1]	0.25	+0.25
38N2E07-07	K	0[1]	0.27	+0.27
38N1E12-05	K	6.89	35.2	+28.31
38N1E12-21	K	0[1]	1.60	+1.60
38N1E12-22	K	15.00[4]	0.58[5]	-14.42
38N1E12-18	K	2.61[6]	1.42[5]	-1.19
38N1E01-25	K	0[1]	0.16[5]	+0.16
38N1E01-10	K	4.54	0.78[5]	-3.76
38N1E01-04	M	10.52	0.75[5]	-9.77
38N1E01-19	O	3.76	0.95[5]	-2.81
38N1E01-26	O	0[1]	0.28[5]	+0.28
38N1E01-27	O	17.60[7]	0.38[5]	-6.36
38N1E23-03	I,H	269.08[8]	46.09	-222.99
38N1E35-05	C	1.95	0.13	-1.82
38N1E35-10	C	0[1]	0.66	+0.66
38N1E35-19	C	0[1]	0.01	+0.01
38N1E35-11	C	0[1]	0.03	+0.03
38N1E35-12	C	0[1]	0.02	+0.02
38N1E35-06	C	4.22[9]	8.35	+4.13
38N1E35-13	C	0[1]	0.32	+0.32
38N1E35-14	C	0[1]	1.05	+1.05
38N1E35-15	C	0[1]	0.25	+0.25
38N1E35-16	C	0[1]	2.99	+2.99
38N1E35-17	C	0[1]	0.01	+0.01
37N1E02-05	C	3.13[10]	7.72	+4.59
37N1E02-03	C	0.58[11]	0.20	-0.38
37N1E35-18	C	0[1]	0.11	+0.11
37N1E02-10	D	0[1]	0.02[12]	+0.02
37N1E02-11	D	0[1]	0.02[12]	+0.02
37N1E02-12	D	0[1]	0.01[12]	+0.01
37N1E02-13	D	0[1]	0.12[12]	+0.12
37N1E02-16	D	0[1]	5.05[12]	+5.05
37N1E02-14	D	0[1]	2.21	+2.21
37N1E02-15	D	0[1]	0.48	+0.48
38N1E23-10	I	0[1]	0.10	+0.10[14]
38N1E23-11	I	0[1]	0.10	+0.10
38N1E23-12	I	0[1]	0.07	+0.07[15]
38N1E23-13	I	0[1]	0.28	+0.28
38N1E23-14	I	0[1]	0.50	+0.50
38N1E04-11	R	3.55[13]	0.88	-2.67
38N1E13-14	K	0[1]	0.20	+0.20[16]
38N1E13-15	K	0[1]	0.10	+0.10[17]
38N1E12-23	K	0[1]	0.10	+0.10
38N1E12-24	K	0[1]	0.05	+0.05
38N1E12-25	K	0[1]	0.04	+0.04
	Total	**346.89**	**125.5**	**-221.4**

Notes:
[1] Wetlands not identified in the 1999 Inventory.
[2] The 1999 Inventory wetland size is 50.49 acres, due to access considerations, 0.56 acre were field-verified for the Year 5 update, which resulted in −0.53 acre difference.
[3] The 1999 Inventory wetland size is 45.89 acres, due to access considerations, 2.90 acres were field-verified for the Year 5 update, which resulted in a +1.54 acres difference.
[4] The 1999 Inventory wetland size is 97.88 acres. A 124.6 acres wetland (38N1E12-18) was field-verified in 2007 and evaluated in the Year 3 update for this 1999 wetland. Due to access considerations and for the purpose of this Year 5 update, 15.00 acres were field verified, which resulted in a −14.42 acres difference.
[5] Preliminary project planning requirements were to identify wetland areas within the road easement, 75 feet from centerline, which resulted in identifying and documenting small wetland areas that may or may not have been identified within a 1999 wetland.
[6] The 1999 Inventory identifies two wetlands (38N1E12-02 and 38N1E12-09) in this area with a combined total of 100.49 acres. The area south of Smuggler's Slough is a verified 124.6 acres wetland (38N1E12-18) evaluated as part of the Year 3 update. The area north of Smuggler's Slough is a 2.61 acres 1999 Inventory wetland that had 1.42 acres field-verified during the Year 5 period. NW Ecological Services rated the area north and south of Smuggler's Slough as one unit, a Riverine-Depressional wetland. For the purpose of the Year 5 update and Table 2, the area north of Smuggler's Slough (2.61 acres) is taken into consideration for the difference of newly verified wetland areas, the difference is −1.19 acres.
[7] 10.68 acres of the 17.60 acres complex wetland was filled in 2000 as part of the Lummi Casino project (Army Corps of Engineers Permit Reference: 1999-4-01575). There is a 0.18 acre verified wetland (38N1E01-21) within this 1999 wetland documented in the Year 4 update. Wetland fill (10.68 acres) and Year 4 wetland (0.18 acres) are a combined total of 10.68 acres. The difference between 17.60 acres and 10.68 acres is −6.74 acres. Therefore, for the purpose of the Year 5 update the difference between −6.74 acres and the Year 5 verified 0.38 acre wetland (38N1E01-27) is −6.36 acres.
[8] The 1999 Inventory indentifies two wetlands (38N1E23-03 and 38N1E23-04) in this area with a combined total of 269.08 acres, which resulted in a −222.99 acres difference.
[9] The 1999 Inventory wetland size is 16.09 acres, due to access considerations, 4.22 acres were field-verified for the Year 5 update, which resulted in a +4.13 acres difference.
[10] The 1999 Inventory wetland size is 13.09 acres, due to access considerations, 3.13 acres were field-verified for the Year 5 Update, which resulted in a +4.59 acres difference.
[11] The 1999 Inventory wetland size is 33.28 acres, due to access considerations, 0.58 acre were field-verified for the Year 5 Update, which resulted in a −0.38 acre difference.
[12] These five 2009 verified wetlands with a total acreage of 5.22 acres are identified within a 2005 verified 17.05 acres Category II wetland numbered 37N1E02-05 mentioned in the Year 1 update. For the purpose of Lummi Planning Department preliminary project planning 9.80 acres was re-verified, which results in a −4.57-acres difference.
[13] The 1999 Inventory size is 26.75 acres, due to access considerations, 3.55 acres were field verified for the Year 5 update, which resulted in a −2.67 acres difference.
[14] This wetland was field-verified in 2004 and mentioned in the Year 1 update. For the purpose of Lummi Planning Department preliminary project planning this wetland was re-verified. The Year 1 update wetland size is 0.13 acre and the Year 5 update wetland size is 0.10 acre, which results in a −0.03 acre difference.
[15] The wetland was field verified in 2004 and mentioned in the Year 1 update. For the purpose of Lummi Planning Department preliminary project planning this wetland was re-verified. There is no difference in wetland size.
[16] This 2009 verified 0.20 acre wetland area is a portion of a 2005 verified wetland number 38N1E13-14 mentioned in the Year 1 update. Due to access considerations, 0.07 acre was field verified. For the purpose of this Year 5 update the verified 0.20 acre are mentioned in Table 2.
[17] This 2009 verified 0.10 acre wetland area is a portion of a 2005 verified wetland number 38N1E13-15 mentioned in the Year 1 update. The Year 1 update wetland size is 0.19 acre and the Year 5 update wetland size is 0.10 acre, which results in a −0.09 acre difference. For the purpose of this Year 5 update the verified 0.10 acre are mentioned in Table 2.

3.2 Results of Function Assessment

Pursuant to the recommendations from the independent program review conducted by ESA Adolfson (ESA Adolfson 2008), wetland function assessments are generally no longer conducted as part of the inventory update effort. Function assessments are only conducted if a development action is planned that will impact a wetland. A function assessment is required to determine appropriate mitigation for unavoidable wetland impacts. As mentioned in the methods section, the WSDOT Wetland Function Characterization Tool For Linear Projects (Null et al. 2000) was used to evaluate eight wetland areas during the Year 5 update.

As described previously, the WSDOT Wetland Function Characterization Tool For Linear Projects is based on Best Professional Judgment (BPJ). The documentation for this tool includes a guidance text section and a field data form intended to be completed in the field. A Wetland Functions and Values Form is also used for summarizing the information from completed field forms for inclusion as an appendix to a wetland evaluation report. The BPJ tool does not quantify wetland functions or provide a comprehensive study of an entire wetland system, and it should not be used when a more intensive study is needed (Null et al. 2000). The purpose of the tool is to provide a consistent format for the rapid characterization of wetland functions for routine linear highway projects. Since it is a qualitative tool rather than a quantitative tool, it is intended for use where a general characterization of wetland functions is needed but extensive field investigation is not practical or necessary.

The BPJ tool was used to assess general wetland and buffer functions, such as water quality, hydrology, and fish and wildlife habitat for the Haxton Way Pedestrian and Bicycle Safety Project (Northwest Ecological Services 2009). The BPJ tool was applied to eight wetland areas. Functions and values evaluated for the eight wetland areas are as follows: flood flow alteration, sediment removal, nutrient and toxicant removal, erosion control and shoreline stabilization, production of organic matter and its export, general habitat suitability, habitat for aquatic invertebrates, habitat for amphibians, habitat for wetland associated mammals, general fish habitat, native plant richness, educational or scientific value, and uniqueness and heritage.

A copy of the Wetland Functions Field Data Form, and copies of the Wetland Functions and Values Form completed for each evaluated wetland area is included in Appendix B. Appendix B also includes a summary of the functions identified for each of these wetlands (Table 1). The general locations of the wetlands that were evaluated are shown in Figure 3, the specific locations are shown on individual maps in Appendix A.

3.3 Results of Wetland Classification

The Washington State Wetland Rating system (Hruby 2004) was applied to all 48 evaluated wetland areas. Table 4 presents the ratings for the AU's.

Of the wetlands evaluated during Year 5, two were rated as Category 1 wetlands, ten were rated as Category 2 wetlands, 34 were rated as Category 3 wetlands, and two were rated as Category 4 wetlands.

The Washington State Wetland Rating system uses only the highest grouping in the HGM classification (i.e., wetland class).

Table 4 – Wetland Rating and HGM Classification

Wetland ID Number	Watershed Identification	Wetland Rating	HGM Class
38N1E26-10	D	3	Depressional
38N1E26-11	D	3	Depressional
38N2E06-03	K	2	Depressional
38N1E12-20	K	3	Depressional
38N2E07-07	K	3	Depressional
38N1E12-05	K	2	Depressional
38N1E12-21	K	2	Depressional
38N1E12-22	K	4	Depressional
38N1E12-18	K	3	Riverine/Depressional
38N1E01-25	K	3	Depressional
38N1E01-10	K	3	Depressional
38N1E01-04	M	2	Riverine
38N1E01-19	O	3	Depressional
38N1E01-26	O	3	Depressional
38N1E01-27	O	3	Depressional
38N1E23-03	I,H	3	Slope
38N1E35-05	C	2	Depressional
38N1E35-10	C	3	Depressional
38N1E35-19	C	3	Depressional
38N1E35-11	C	3	Depressional
38N1E35-12	C	2	Depressional
38N1E35-06	C	2	Depressional
38N1E35-13	C	3	Depressional
38N1E35-14	C	3	Depressional
38N1E35-15	C	3	Depressional
38N1E35-16	C	3	Depressional
38N1E35-17	C	3	Depressional
37N1E02-05	C	3	Depressional
37N1E02-03	C	3	Depressional
37N1E35-18	C	2	Depressional
37N1E02-10	D	3	Depressional
37N1E02-11	D	3	Depressional
37N1E02-12	D	3	Depressional
37N1E02-13	D	3	Depressional
37N1E02-16	D	1[1]	Depressional
37N1E02-14	D	1[1]	Depressional
37N1E02-15	D	2	Depressional
38N1E23-10	I	3	Depressional
38N1E23-11	I	3	Depressional
38N1E23-12	I	4	Depressional
38N1E23-13	I	3	Depressional
38N1E23-14	I	3	Depressional
38N1E04-11	R	2	Depressional
38N1E13-14	K	3	Depressional
38N1E12-25	K	3	Depressional
38N1E13-15	K	3	Depressional
38N1E12-23	K	3	Depressional
38N1E12-24	K	3	Depressional

[1] These wetland areas are rated as Mature Forest.

4. DISCUSSION

Accurate information on wetland locations and areal extent, wetland category, and wetland functions is needed in order to effectively manage Reservation wetlands pursuant to the Lummi Nation Water Resources Protection Code (LCL Title 17). Although the 1999 inventory represents an important planning tool and a significant improvement over the previously available information, it has proven to be too general for many planning efforts. Refining the spatial resolution of the wetland mapping and classifying the wetlands into the regulatory categories identified in Title 17 is intended to support efforts to protect these wetland resources and the important ecological, hydrological, and water quality protection functions that they provide. Because of the large number of wetland areas on the Reservation, the effort to refine the spatial resolution of the wetland mapping and to classify the Reservation wetlands is projected to require several years to complete. This report summarizes the results of Year 5 of this inventory update effort.

The overall result of the inventory update effort will be a more accurate GIS data layer and an associated database that contains the classification and other summary information about each wetland on the Reservation. Hard copies of field notes (e.g., wetland rating worksheets, function assessment work sheets, location maps) are maintained in binders in the Lummi Water Resources Division office. Until the update effort is completed, the GIS data layer and associated database will be a work in progress. The current version of the Lummi Reservation Wetland Map is shown in Figure 4. Figure 4 shows the information in Figure 3 except that the 1999 wetland locations that were revised during Year 1 through Year 5 of this update effort has been modified accordingly. Figure 4 is intended to reflect the best available information on Reservation wetlands.

As described previously, Year 5 of this inventory update resulted in revising the locations and extent of 48 wetland areas, collecting additional information on the functions of 8 wetlands, and classifying all 48 wetlands into one of four categories. Based on the changes to the spatial locations and the utility of the collected information on wetland function and category, the inventory update is recommended to continue until it is completed.

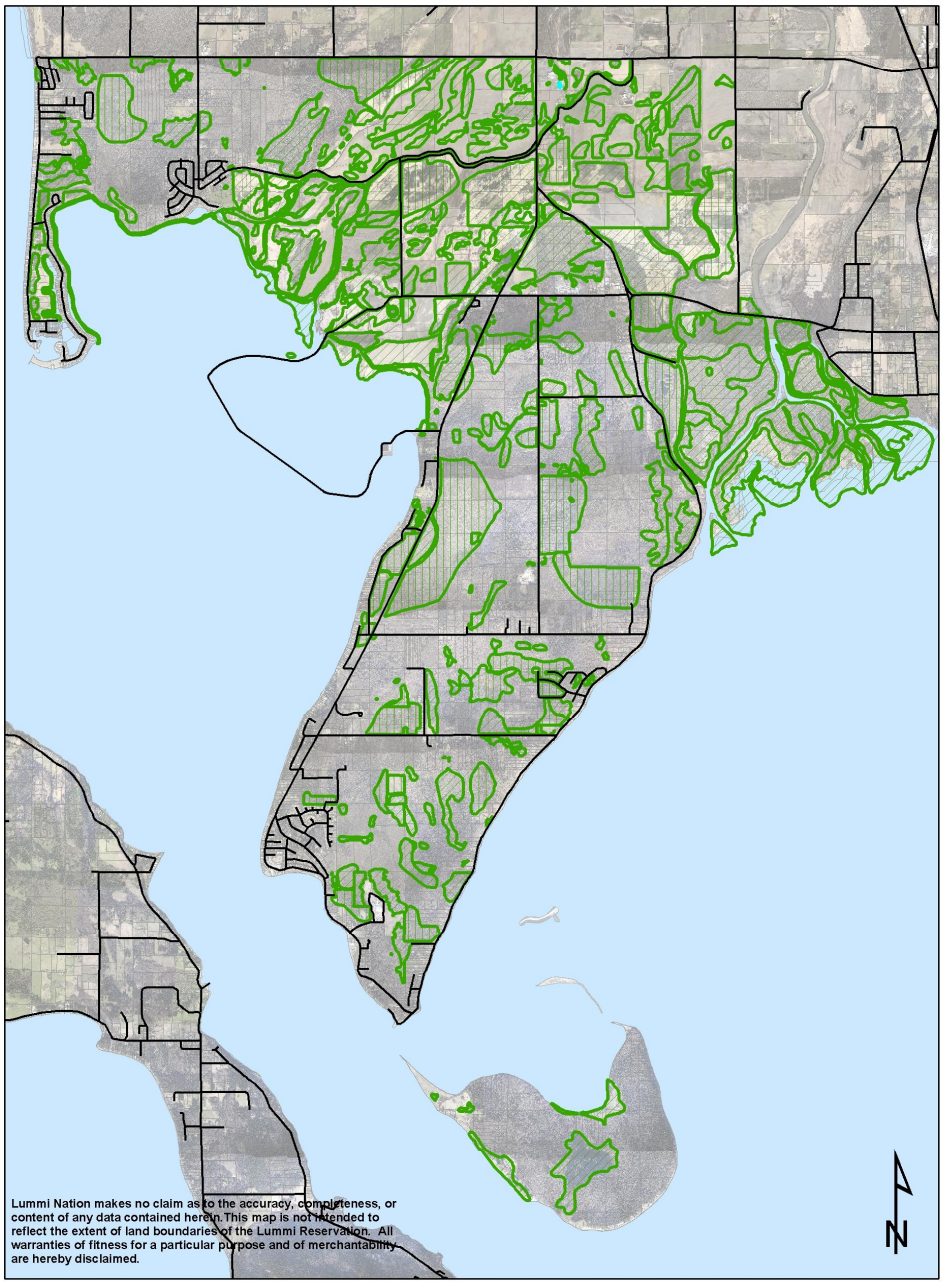
Because of the amount of time and resources required to complete the inventory update the approach was modified starting during Year 4. The wetland function assessments are now deferred until a development action is planned that will impact a wetland and a function assessment is required to determine appropriate mitigation for unavoidable wetland impacts. The modified approach retains the goal to improve the spatial resolution of the Reservation wetland inventory and the effort to classify/rate the Reservation wetlands into one of four categories to support the implementation of Title 17 and the associated determination of the appropriate buffer width. The modification is anticipated to allow more of the

Reservation wetlands to be visited during a year and to accelerate the completion of the inventory update.

At the end of Year 5 of this update effort, a total of 155 wetland areas were evaluated. As 214 wetland areas were identified as part of the 1999 Reservation-wide inventory, approximately 72 percent of the wetlands on the Reservation have been evaluated. The percentage of the total number of Reservation wetlands evaluated is actually less than 72 percent since this update effort has also identified a number of smaller wetlands that were not identified during the 1999 inventory.

Future phases of this study will include estuarine wetlands, which are Category 1 wetlands if they are relatively undisturbed and are larger than one acre. Estuarine wetlands are not included in the classes of wetlands that are covered by the WAFAM method at this time, so a different method will be needed, or the evaluation of these wetlands will have to be delayed until the methodology is developed.

Figure 4 - Best Available Wetland Inventory Map (November 2008)



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APPENDIX A – INDIVIDUAL WETLAND MAPS

APPENDIX B – COPIES OF WETLAND FUNCTIONS AND VALUES FORM AND SUMMARY OF FUNCTIONS IDENTIFIED

able 1. Will The Function Or Value Likely Be Provided, A Brief Description Of Rationale

Unit And Wetland Name	Flood Flow Alteration	Sediment Removal	Nutrient And Toxicant Removal	Erosion Control And Shoreline Stabilization	Production Of Organic Matter And Its Export	General Habitat Suitability	Habitat For Aquatic Invertebrates	Habitat For Amphibians	Habitat For Wetland Associated Mammals	Habitat For Wetland Associated Birds	General Fish Habitat	Native Plant Richness	Education Or Scientific Value	Uniqueness And Heritage
A 38N1E12-22	Yes, Capable of retaining higher volumes of water during a storm event.	Yes, Dense herbaceous veg. is present and ponding of water occurs in the wetland.	Yes, Sources of excess nutrients (fertilizers) and toxicants are present upgradient.	No	Yes, Wetland has at least 30% areal cover of dense herbaceous vegetation and outlet.	Yes, Wetland has connectivity with other habitat types.	Yes, Wetland must have permanent or evidence of seasonal inundation for this function to be provided.	Yes, Wetland contains areas of seasonal and/or permanent standing water in most years.	No	Yes, Has 30 to 50% shallow open water and/or aquatic bed classes present within the wetland.	No	No	No	Yes, Wetland contains documented critical habitat, high quality ecosystems, or priority species.
B 38N1E12-18	Yes, Wetland receives floodwater from an adjacent water course.	Yes, Dense herbaceous veg. is present and ponding of water occurs in the wetland.	Yes, Sources of excess nutrients (fertilizers) and toxicants are present upgradient.	Yes, Has dense vegetation, trees and shrubs able to withstand erosive flood events are also part of this vegetation.	Yes, Wetland has at least 30% areal cover of dense herbaceous vegetation and woody plants are mostly deciduous.	Yes, Wetland has connectivity with other habitat types.	Yes, Wetland must have permanent or evidence of seasonal inundation for this function to be provided	Yes, Wetland contains areas of seasonal and/or permanent standing water in most years.	Yes, Permanent water present within the wetland. (Must be present to provide this function)	Yes, Has 30 to 50% shallow open water and/or aquatic bed classes present within the wetland.	Yes, Wetland has a perennial or intermittent surface-water connection to a fish-bearing water body.	Yes, Dominant and codominant plants are native.	No	Yes, Wetland contains documented critical habitat, high quality ecosystems, or priority species.
C 38N1E01-25	Yes, Wetland is a closed (depressional) system.	Yes, Dense herbaceous veg. is present and ponding of water occurs in the wetland.	Yes, Sources of excess nutrients (fertilizers) and toxicants are present upgradient.	No	Yes, Wetland has at least 30% areal cover of dense herbaceous vegetation. and outlet	Yes, Wetland has more than one Cowardin Class, i.e., (PFO, PSS, PEM, PAB, POW, etc.)	Yes, Wetland must have permanent or evidence of seasonal inundation for this function to be provided	Yes, Wetland contains areas of seasonal and/or permanent standing water in most years.	No	Yes, Emergent, forested, and scrub-shrub vegetation class present within the wetland.	No	No, Wetland contains two or more Cowardin Classes	No	Yes, Wetland contains documented critical habitat, high quality ecosystems, or priority species.
D 38N1E01-10	Yes, Capable of retaining higher volumes of water during a storm event.	Yes, Dense herbaceous veg. is present and ponding of water occurs in the wetland.	Yes, Sources of excess nutrients (fertilizers) and toxicants are present upgradient.	No	Yes, Wetland has at least 30% areal cover of dense herbaceous vegetation and outlet.	No	Yes, Wetland must have permanent or evidence of seasonal inundation for this function to be provided.	Yes, Wetland contains areas of seasonal and/or permanent standing water in most years.	No	Yes, Has 30 to 50% shallow open water and/or aquatic bed classes present within the wetland.	No	No	No	Yes, Wetland contains documented critical habitat, high quality ecosystems, or priority species.

Unit And Wetland Name	Flood Flow Alteration	Sediment Removal	Nutrient And Toxicant Removal	Erosion Control And Shoreline Stabilization	Production Of Organic Matter And Its Export	General Habitat Suitability	Habitat For Aquatic Invertebrates	Habitat For Amphibians	Habitat For Wetland Associated Mammals	Habitat For Wetland Associated Birds	General Fish Habitat	Native Plant Richness	Education Or Scientific Value	Uniqueness And Heritage
E 38N1e01-04	Yes, If flowthrough, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris.	Yes, Sources of excess sediment (from tillage or construction) are present upgradient of the wetland.	Yes, Sources of excess nutrients (fertilizers) and toxicants are present upgradient.	Yes, Has dense vegetation, trees and shrubs able to withstand erosive flood events are also part of this vegetation.	Yes, Wetland has at least 30% areal cover of dense herbaceous vegetation and woody plants are mostly deciduous.	Yes, Wetland has more than one Cowardin Class, i.e., (PFO, PSS, PEM, PAB, POW, etc.)	Yes, Wetland must have permanent or evidence of seasonal inundation for this function to be provided.	Yes, Other wetlands and/or an intermittent or perennial stream within 1 km (0.6 mi) of wetland.	Yes, Permanent water present within the wetland. (Must be present to provide this function)	Yes, Emergent, forested, and scrub-shrub vegetation class present within the wetland.	Yes, Wetland has a perennial or intermittent surface-water connection to a fish-bearing water body.	Yes, Dominant and codominant plants are native, wetland contains two or more Cowardin Classes	No	Yes, Wetland contains documented occurrence of a state or federally listed threatened or endangered species.
F 38N1E01-19	Yes, Capable of retaining higher volumes of water during a storm event.	Yes, Sources of excess sediment (from tillage or construction) are present upgradient of the wetland.	Yes, Sources of excess nutrients (fertilizers) and toxicants are present upgradient.	No	Yes, Wetland has at least 30% areal cover of dense herbaceous vegetation and outlet.	No	Yes, Emergent vegetation present within ponded area.	Yes, Other wetlands and/or an intermittent or perennial stream within 1 km (0.6 mi) of wetland.	No	Yes, Emergent vegetation class present within the wetland and contains invertebrates, amphibians, and/or fish.	No	No	No	Yes, Wetland contains documented occurrence of a state or federally listed threatened or endangered species.
G 38N1E01-26	Yes, Capable of retaining higher volumes of water during a storm event.	Yes, Sources of excess sediment (from tillage or construction) are present upgradient of the wetland.	Yes, Sources of excess nutrients (fertilizers) and toxicants are present upgradient.	No	Yes, Wetland has at least 30% areal cover of dense herbaceous vegetation and outlet.	No	Yes, Wetland must have permanent or evidence of seasonal inundation for this function to be provided.	Yes, Wetland contains areas of seasonal and/or permanent standing water in most years.	No	Yes, Has 30 to 50% shallow open water and/or aquatic bed classes present within the wetland.	No	No	No	Yes, Wetland contains documented occurrence of a state or federally listed threatened or endangered species.
H 38N1E01-27	Yes, Capable of retaining higher volumes of water during a storm event.	Yes, Dense herbaceous veg. is present and ponding of water occurs in the wetland.	Yes, Sources of excess nutrients (fertilizers) and toxicants are present upgradient.	No	Yes, Wetland has at least 30% areal cover of dense herbaceous vegetation and outlet.	No	Yes, Wetland must have permanent or evidence of seasonal inundation for this function to be provided.	Yes, Wetland contains areas of seasonal and/or permanent standing water in most years.	No	Yes, Has 30 to 50% shallow open water and/or aquatic bed classes present within the wetland.	No	No	No	Yes, Wetland contains documented occurrence of a state or federally listed threatened or endangered species.

APPENDIX C – SAMPLE OF WETLAND RATING WORKSHEETS